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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/595,994	**Applicant(s)** NAM, WON SIK	
	Examiner TIFFANY NUCKOLS	**Art Unit** 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 May 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3 and 5-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3 and 5-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

   1. Determining the scope and contents of the prior art.
   2. Ascertaining the differences between the prior art and the claims at issue.
   3. Resolving the level of ordinary skill in the pertinent art.
   4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. **Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6391804 to Grant et al in view of U.S. Patent Application No. 2005/0268567 to Devine et al.**

4. In regards to Claim 1, Grant et al teach a rapid thermal processing reactor, i.e., system (*See Grant et al, 10 Figure 1*) with a chamber (*See Grant et al, 12 Figure 1*), a gas inlet manifold (*See Grant et al, 24 Figure 1*), and gas outlet manifold (*See Grant et al, 26 Figure 1*). The gas inlet manifold, i.e., gas injection port, is located on the opposite side of the system from the gas outlet manifold, i.e., gas exhaust port, such that both of them are on opposite lateral walls. The system has a heat source (*See Grant et al, 54a-54n Figure 1*) installed in the chamber for heating a wafer (*See Grant et

al, 36 Figure 1). A quartz window (*See Grant et al, 20 Figure 1*) is mounted above the wafer and below the heat source. A wafer or guard ring (*See Grant et al, Column 3, lines 6-25 and 38 Figure 1*), i.e., edge ring is placed on a guard ring support (*See Grant et al, 34a-34n Figure 1*), i.e., edge ring support below the quartz window. The chamber (*See Grant et al, 12 Figure 2*) has an hexagonal inner surface that is free of corners, such that a cross-section of the chamber shows a multi-line shape consisting of a plurality of arcs separated from each other and having the same radius and the same center and a plurality of straight lines connecting the arcs to each other (*See Grant et al, Figure 2*). Grant et al teaches the chamber has six straight line sides and six curves connected by the straight lines. The chamber there has six lines and six arcs distributed around 360°, such that the twelve lines/arcs could be divided equally around the chamber and the arcs would have an implicit relative central angle of 30°.

5. Grant et al does not teach the outer peripheral surface of the quartz window consists of a combination of a tilt surface, a perpendicular surface, and a round surface.

6. Devine et al teach of a support surface (*See Devine et al, 159a Figure 3*) which is oblique, i.e., tilted and a sealing surface (*See Devine et al, 159b Figure 3*) which is perpendicular, on the outer peripheral surface of the quartz window (*See Devine et al, 120 Figure 3*). The tilted and the perpendicular surfaces are connected by a rounded corner, i.e., surface (*See Devine et al, Rounded Corners of 120 Figure 3*). The surface configurations evenly distribute the biasing forces and pressure differential produced forces in the chamber (*See Devine et al, Paragraph 0041*) which prevents the development of localized high stress points (*See Devine et al, Paragraph 0038*) which

can lead to fractures in the window (*See Devine et al, Paragraph 0007*). It is noted that Devine et al also teaches that the window can be inverted as desired without limitation (*See Devine et al, Paragraph 0031*).

7. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the rapid thermal processing chamber as taught by Grant et al, by improving the window with a multi-surfaced quartz window, as taught by Devine et al. One would be motivated to do so, with a reasonable expectation of success, in order to evenly distribute the biasing forces and pressure differential produced forces in the chamber in order to prevent localized high stress points which lead to fractures in the window.

8. In regards to Claim 3, Grant et al does not teach an O-ring is interposed between an outer peripheral surface of the quartz window and a mounting portion of the chamber at which the quartz window is mounted.

9. Devine et al teach of a chamber arrangement for rapid thermal processing (*See Devine et al, Paragraph 0002*). The chamber arrangement (*See Devine et al, 102 Figure 2*) has a quartz window (*See Devine et al, 120 Figure 2*) mounted on a window aperture, i.e., mounting portion of the chamber (*See Devine et al, 108 Figure 2 and Paragraph 0025*). Devine et al further teach of an embodiment of this chamber arrangement where an O-ring (*See Devine et al, 154 Figure 3*) is in contact with the outer diameter, i.e., outer peripheral surface, of the quartz window and a portion of the mounting potion of the chamber (*See Devine et al, Paragraph 0042*). Devine et al teach that this embodiment uses the o-ring to achieve a vacuum seal of the chamber (*See*

Devine et al, Paragraph 0041-0042) which is desirable to obtain the desired leak rate of the chamber (*See Devine et al, Paragraph 0006*), i.e., prevent leakage of the chamber.

10. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the rapid thermal processing chamber as taught by Grant et al, by improving the quartz window with an o-ring vacuum sealed quartz window, as taught by Devine et al. One would be motivated to do change the window, with a reasonable expectation of success, in order to achieve a vacuum seal of the chamber with a desired leak rate, i.e., prevent leakage of the chamber.

11. **Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6391804 to Grant et al in view of U.S. Patent Application No. 2005/0268567 to Devine et al, as applied to Claim 1 above, and in further view of U.S. Patent No. 6501191 to Tanaka et al.**

12. The teachings of Grant et al in view of Devine et al are relied upon as set forth above.

13. In regards to Claim 7, Grant et al do not teach each of the processing gas exhaust ports is provided with an oxygen concentration detector.

14. Tanaka et al teach a heat treatment apparatus (*See Tanaka et al, 20 Figures 9 and 10*) with oxygen sensors (*See Tanaka et al, 89a-c Figures 9 and 10*) that detect oxygen concentration upstream of the exhaust mechanism, i.e., processing gas exhaust ports. The oxygen sensors, i.e., oxygen concentration detectors are used to detect oxygen concentrations as oxygen levels above predetermined limits increase the dielectric constant of the formed interlayer insulating film, rendering the films nonuniform

in the film quality of the wafer (*See Tanaka et al, Column 1 lines 44-49*). Tanaka teaches that increased oxygen concentrations during processing increases the dielectric constant of the formed interlayer insulating film, which renders the films nonuniform in the film quality of every wafer (*See Tanaka et al, Column 1 lines 31-49*).

15. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing system of Grant et al in view of Devine et al by adding oxygen concentration detectors with each of the processing exhaust ports, as taught by Tanaka et al. One would be motivated to do so, with a reasonable expectation of success, to monitor oxygen levels to keep them at or below a predetermined limit to ensure the film quality of every wafer.

16. In regards to Claim 8, Grant et al in view of Devine et al do not teach the chamber is formed with a wafer feeding passage in the lateral wall of the chamber, and the processing gas injection nozzle connected to the processing gas injection ports are formed on a lateral wall of the wafer feeding passage.

17. Tanaka et al teach a cooling process chamber (*See Tanaka et al, 82 Figures 9 and 10*), i.e., wafer feeding passage is supplied with the same gas as the process chamber, and connected to a process chamber (*See Tanaka et al, 81 Figures 9 and 10*), i.e., the processing gas injection nozzle connected to the processing gas injection ports are formed on a lateral wall of the wafer feeding passage. The wafer feeding passage is supplied with the same gas as the process chamber to maintain the atmosphere within the process chamber and the wafer feeding passage at a low oxygen concentration (*See Tanaka et al, Column 8 lines 19-22*). Tanaka teaches that

increased oxygen concentrations during processing increases the dielectric constant of the formed interlayer insulating film, which renders the films nonuniform in the film quality of every wafer (*See Tanaka et al, Column 1 lines 31-49*).

18. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing system as taught by Grant et al with the wafer feeding passage and processing gas injection port arrangement as taught by Tanaka et al. One would be motivated to do so, with a reasonable expectation of success, to maintain the atmosphere within the process chamber and the wafer feeding passage at a low oxygen concentration to prevent the nonuniformity of the film quality of every wafer.

19. **Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6391804 to Grant et al in view of U.S. Patent Application No. 2005/0268567 to Devine et al, as applied to Claim 1 above, and in further view of U.S. Patent No. 6133152 to Bierman et al.**

20. The teachings of Grant et al in view of Devine et al are relied upon as set forth above.

21. In regards to Claim 9, Grant et al in view of Devine et al do not teach the edge ring-support comprises: a rotational member installed in the chamber and having a rotational wing with a groove formed on an upper surface of the rotational wing; a cylinder connected to the rotational wing and mounting the edge ring on an upper surface of the cylinder; a cylinder guide engaged with the cylinder; and a cylinder guide-fixing pin for fixing the cylinder guide to the rotational wing.

22. Bierman et al teach an rapid thermal processing chamber (*See Bierman et al, 100 Figure 2*) with a rotor system (*See Bierman et al, 111 Figure 2*), i.e., rotational member with an edge ring (*See Bierman et al, 119 Figure 5*) that is supported by a support cylinder (*See Bierman et al, 115 Figure 5*), such that the edge ring is mounted on an upper surface of the cylinder (*See Bierman et al, Figure 5*). The cylinder is connected to a rotor (*See Bierman et al, 113 Figure 5*), i.e., rotational wing, which has a groove on an upper surface for receiving locator pins (*See Bierman et al, 123 Figure 5*), i.e., cylinder guide. The cylinder guide touches the cylinder, i.e., is engaged with the cylinder and has a pin plug (*See Bierman et al, 159 Figure 5*), i.e., cylinder guide-fixing pin, that friction-fit secures, or fixes, the cylinder guide to the rotational wing (*See Bierman et al, Column 8 lines 39-44*). The rotational member taught by Bierman reduces the occurrence of multiple gas vortices in a semiconductor processing chamber, which in turn reduces film non-uniformity (*See Bierman et al, Column 2 lines 23-31 and Column 4 lines 32-50*), i.e., improves processing quality.

23. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing system's edge ring-support as taught by Grant et al in view of Devine et al, with the rotational member for substrate support of Bierman et al. One would be motivated to do so, with a reasonable expectation for success, to reduce the occurrence of multiple gas vortices in a semiconductor processing chamber, which in turn reduces film non-uniformity, i.e., improves processing quality.

24. In regards to Claim 10, Grant et al in view of Devine et al do not teach a rapid thermal processing system further comprising a cooling/heating water-circulation passage provided in an inner wall of the chamber such that the circulation passage surrounds an outer peripheral surface of the edge ring and a predetermined area of the edge ring-support.

25. Bierman et al teach of a water-cooled stainless steel bearing cover (*See Bierman et al, 161 Figure 5*), i.e., a cooling/heating water circulation passage provided in an inner wall of the chamber such that the circulation passage surrounds an outer peripheral surface of the edge ring and a predetermined area of the edge ring support (*See Bierman et al, Column 9 lines 22-25*). The water circulation passage protects components below it from corrosion by the deposition process (*See Bierman et al, Column 9 lines 22-29*). Bierman et al further teaches a circulation circuit with chambers (*See Bierman et al, 146 Figure 5*) fed by coolant inlets (*See Bierman et al, 185 Figure 5*) for circulating cooled gas or liquid (*See Bierman et al, column 6 lines 62-65*) that behaves as a cooling reflector to enable precise temperature measurements (*See Bierman et al, Column 2 lines 11-19)* and can alternatively be a cooling/heating water circulation passage provided in an inner wall of the chamber such that the circulation passage surrounds an outer peripheral surface of the edge ring and a predetermined area of the edge ring support.

26. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing system as taught by Grant et al in view of Devine et al, with the cooling/heating water circulation passages as taught by

Bierman. One would be motivated to do so, with a reasonable expectation of success, to protect the components below it from corrosion and to provide a cooling reflector for precise temperature measurements.

27. **Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6391804 to Grant et al in view of U.S. Patent Application No. 2005/0268567 to Devine et al, as applied to Claim 1 above, and in further view of U.S. Patent Application No. 2006/0057799 to Horiguchi et al.**

28. The teachings of Grant et al in view of Devine et al are relied upon as set forth above.

29. In regards to Claim 12, Grant et al does not teach the first cooling gas injection part comprises a plurality of injection holes radially arranged therein, and a cap installed at an upper portion of the injection holes to define a predetermined space opened between the injection holes and the cap.

30. Horiguchi et al teach of a substrate processing apparatus, i.e., rapid thermal processing system, with a processing vessel, i.e., chamber with an inner surface of arcs connected by straight lines (*See Horiguchi et al, 22 Figure 9*), a rotational drive unit edge ring-support (*See Horiguchi et al, 28 Figure 9*) with a susceptor (*See Horiguchi et al, 118 Figure 9*), i.e., edge ring, and a gas supply unit (*See Horiguchi et al, 34 Figure 9*). Horiguchi et al further teaches that the gas supply openings has a gas injection nozzle unit (*See Horiguchi et al, 93 Figure 19*) which is connected to a supply line (*See Horiguchi et al, 99 Figure 19*) with radially arranged injection holes (*See Horiguchi et al, 93_{a1}-93_{an} Figure 19 and Figure 20*), and nozzle plates(*See Horiguchi et al, 93_{b1}-93_{bn}*

Figure 19), i.e., caps, installed at an upper portion of the injection holes to define a predetermined space (*See Horiguchi et al, 93_{c1}-93_{c3} Figure 19*) opened between the injection holes and the cap. Horiguchi et al teach that the gas nozzle apparatus directs the gas injection through the entire width of the processing space at a constant flow rate to produce an evenly formed film on the substrate, i.e., wafer (*See Horiguchi et al, Paragraph 0185 and 0191*).

31. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the gas injection ports of Grant et al by adding a nozzle as taught by Horiguchi et al. One would be motivated to do so, with a reasonable expectation of success, to direct the gas through the entire width of the processing space at a constant flow rate to produce an evenly formed film on the wafer.

32. **Claims 1, 3, 4, 5, 6, 8, 11, and 13 rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6143079 to Halpin in view of U.S. Patent No. 6391804 to Grant et al and U.S. Patent Application No. 2005/0268567 to Devine et al.**

33. In regards to Claim 1, Halpin teaches a semiconductor processing reactor (*See Halpin, 8 Figures 1 and 2*), i.e., rapid thermal processing system, comprising: a chamber (*See Halpin, 10 Figures 2*) with an inlet port provided at a lateral wall of the chamber (*See Halpin, the channel of 116 Figures 1 and 2*), i.e., a processing gas injection port, and at the opposite lateral wall thereof an exhaust manifold (*See Halpin, 124 Figure 2*), i.e., a processing gas exhaust ports. Halpin teaches a heating element (*See Halpin, 89 Figures 1 and 2*), i.e., heat source installed in the chamber for heating a

wafer (*See Halpin, Column 5 lines 49-51 and 56 Figure 2*); a transparent upper wall made of quartz (*See Halpin, 12 Figures 1 and 2, Column 5 lines 49-51*), i.e., quartz window mounted on the chamber such that the quartz window is located below the heat source; a spider, (*See Halpin, 40 Figure 2*) i.e., edge ring-support installed in the chamber such that edge ring-support can be located below the quartz window; and a wafer holder (*See Halpin, 36 Figure 2*), i.e., an edge ring equipped on the edge ring-support for mounting the wafer. Halpin teaches the chamber has an inner surface with a top-down cross-section in a multi-line shape consisting of a plurality of arcs separated from each other and having the same radius and the same center and a plurality of straight lines connecting the arcs to each other (*See Halpin, Column 4, lines 65-67 and Figure 3*). Halpin further teaches the chamber has a side cross-section of the inner surface in a multi-line shape consisting of a plurality of arcs separated from each other and having the same relative radius and the same relative center and a plurality of straight lines connecting the arcs to each other (*See Halpin, Figure 2 and Figure 3*). Although Halpin it can be argued that does not explicitly teach that the apparatus is for rapid thermal processing, the apparatus as taught by Halpin is structurally capable of performing the intended use and therefore anticipates rapid thermal processing. It has been held that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959).* Also, a claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the

structural limitations of the claim. *Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).* MPEP 2114 and MPEP 2115.

34. Halpin does not explicitly disclose that the arcs have a central angle of 15-50°.

35. Grant et al teaches the chamber has six straight line sides and six curves connected by the straight lines (*See Grant et al, Figure 2*). The chamber there has six lines and six arcs distributed around 360°, such that the twelve lines/arcs could be divided equally around the chamber and the arcs would have an implicit relative central angle of 30°. Furthermore, Grant et al teaches that the wafer exhibits spatial temperature nonuniformities that are dependent on the walls of the enclosed process chamber (*See Grant et al, Column 1 lines 63-67 and Column 2 lines 1-2*) and that the generally hexagonal enclosed process chamber is shaped in order to reduce temperature measurement errors induced by lamp radiation by the concentrically located edge ring (*See Grant et al, Column 2 lines 62-67 and Column 3 lines 1*-5), such that the shape of the chamber is a result-effective variable in uniformly processing the wafer.

36. It would have been obvious to one of ordinary skill in the art at the time of the invention to alternatively modify the teachings of Halpin to change the size of the relative central angle of the arcs as taught by Grant et al, through routine experimentation, for the predictable result reduce temperature measurement errors induced by lamp radiation and prevent wafer spatial temperature nonuniformities. It is noted that Applicant has not made any showing of criticality in the size of the central angle that would tend to point toward the non-obviousness of freely selecting any arc

central angle as a matter of choice to obtain desired temperature uniformity. See MPEP 2144 - IV.

37. In regards to Claim 3, Grant et al does not teach an O-ring is interposed between an outer peripheral surface of the quartz window and a mounting portion of the chamber at which the quartz window is mounted.

38. Halpin does not teach the outer peripheral surface of the quartz window consists of a combination of a tilt surface, a perpendicular surface, and a round surface.

39. Devine et al teach of a chamber arrangement for rapid thermal processing (*See Devine et al, Paragraph 0002*). The chamber arrangement (*See Devine et al, 102 Figure 2*) has a quartz window (*See Devine et al, 120 Figure 2*) mounted on a window aperture, i.e., mounting portion of the chamber (*See Devine et al, 108 Figure 2 and Paragraph 0025*). Devine et al further teach of an embodiment of this chamber arrangement where an O-ring (*See Devine et al, 154 Figure 3*) is in contact with the outer diameter, i.e., outer peripheral surface, of the quartz window and a portion of the mounting potion of the chamber (*See Devine et al, Paragraph 0042*). Devine et al teach that this embodiment uses the o-ring to achieve a vacuum seal of the chamber (*See Devine et al, Paragraph 0041-0042*) which is desirable to obtain the desired leak rate of the chamber (*See Devine et al, Paragraph 0006*), i.e., prevent leakage of the chamber. Devine et al teach of a support surface (*See Devine et al, 159a Figure 3*) which is oblique, i.e., tilted and a sealing surface (*See Devine et al, 159b Figure 3*) which is perpendicular, on the outer peripheral surface of the quartz window (*See Devine et al, 120 Figure 3*). The tilted and the perpendicular surfaces are connected by a rounded

corner, i.e., surface (*See Devine et al, Rounded Corners of 120 Figure 3*). The surface configurations evenly distribute the biasing forces and pressure differential produced forces in the chamber (*See Devine et al, Paragraph 0041*) which prevents the development of localized high stress points (*See Devine et al, Paragraph 0038*) which can lead to fractures in the window (*See Devine et al, Paragraph 0007*). It is noted that Devine et al also teaches that the window can be inverted as desired without limitation (*See Devine et al, Paragraph 0031*).

40. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the rapid thermal processing chamber as taught by Halpin, by improving the window with a multi-surfaced quartz window, as taught by Devine et al. One would be motivated to do so, with a reasonable expectation of success, in order to evenly distribute the biasing forces and pressure differential produced forces in the chamber in order to prevent localized high stress points which lead to fractures in the window.

41. In regards to Claim 3, Halpin teaches a quartz side wall (*See Halpin, 18 Figure 2, Column 6 lines 40-45*) which is intimately connected to the quartz window, forming an outer peripheral surface of the quartz window. Halpin teaches an O-ring (*See Halpin, 126 Figure 2*) is interposed between the outer peripheral surface of the quartz window and a flange (*See Halpin, 20 Figure 2*), i.e., mounting portion of the chamber at which the quartz window is mounted (*See Halpin, 126 Figure 2*).

42. In regards to Claim 4, Halpin teaches an outer peripheral surface of the quartz window consists of a combination of a perpendicular surface (*See Halpin, Figure 2*), a

round surface (*See Halpin, 52 Figure 2*) and a parallel surface which inclines away from the round surface, i.e., a tilt surface (*See Halpin, 46 Figure 2*).

43. In regards to Claim 5, Halpin teaches the quartz window has an area larger than that of the inner surface of the chamber (*See Halpin, Figure 2*) and positioned outside of the inner chamber, i.e., positioned at the outside of the straight line portion. Halpin teaches that the quartz window is bigger than the inner chamber such that window inherently has sides parallel, i.e., opposing to the inner chambers' straight line portion. Halpin also teaches that the quartz window can be square in shape (*See Halpin, Column 8 lines 5-10).* Halpin further teaches a system further comprising walls that are cooled by forced air or liquid cooling across outer, lower surfaces of the quartz windows (*See Halpin, 50 and 60 Figure 2*) or in through-holes bored through said windows to cool the straight line portion of the inner surface of the chamber (*See Halpin, Column 13 lines 49-65 and 48 and 58 Figure 2*), i.e., one or more cooling water jackets, each being installed in the chamber such that the cooling water jacket can be positioned at a lower portion of a region defined by the edge of the quartz window and the straight line portion of the inner surface of the chamber.

44. In regards to Claim 6, Halpin teaches the chamber has a gas injector (*See Halpin, 112 Figure 2*), i.e., injection pipe, is connected to a reactant gas flow needle valve (*See Halpin, 114 Figure 2*), i.e., processing gas injection nozzle. The channel below the injection nozzle, i.e., processing gas injection port is aligned in the injection pipe. Halpin et al teaches the processing gas exhaust port (*See Halpin, 124 Figure 2*) is formed with at least two exhaust ports (*See Halpin, 24, 26, 28 122 Figure 2*) aligned in

the processing gas exhaust port and having a height, i.e., diameter larger that of the processing gas injection port (*See Halpin, Figure 2 and Column 12 lines 26-37*).

45. In regards to Claim 8, Halpin teaches that an inlet (*See Halpin, 22 Figure 2*), i.e., wafer feeding passage has the processing injection nozzle connected to the processing injection ports formed on a wall of the wafer feeding passage (*See Halpin, Column 11 lines 16-23*). Halpin further teaches that the injection ports can be arranged in a separate outside flange that interfaces with the gate valve, i.e., formed on a lateral wall of the wafer feeding passage (*See Halpin, Column 11 lines 23-27*).

46. In regards to Claim 11, Halpin et al teach of a purge gas supply (*See Halpin, 44 Figure 2*), i.e., cooling gas injection part for injecting a cooling gas into the chamber and a lower longitudinal aperture (*See Halpin, 102 Figure 2*), i.e., a cooling gas exhaust part, which is located near the outlet port (*See Halpin, 24 Figure 2*), to be evacuated outside of the chamber (*See Halpin, Column 12 lines 12-25*). The first cooling gas injection part and the first cooling gas exhaust part being installed on lower portion (*See Halpin, 32 Figure 2*), i.e., the bottom surface, of the chamber. Although Halpin does not teach that the purge gas is a cooling gas, the particular type of gas used is a process limitation rather than an apparatus limitation, and the recitation of a particular type of gas does not limit an apparatus claim, see *In re Casey,* 152 USPQ 235; *In re Rishoi,* 94 USPQ 71; *In re Young,* 25 USPQ 69; *In re Dulberg,* 129 USPQ 348; *Ex parte Thibault,* 64 USPQ 666; and *Ex parte Masham,* 2 USPQ2d 1647. MPEP 2114 and MPEP 2115.

47. In regards to Claim 13, Halpin et al teach that the gas injector (*See Halpin, 112 Figure 2*) on the lateral wall of the chamber includes a plurality of reactant gas flow

needle valves (*See Halpin, 114 Figure 2*) for supplying gases through a plurality of spaced apart ports (*Halpin, Column 11, Lines 9-27)*. At least some of the gas ports may be considered as making up a second cooling gas part, wherein said gas ports are spaced apart from other ports which may be considered as the processing gas inject ports. Although Halpin does not expressly teach that the process gas is a cooling gas, the particular type of gas used is a process limitation rather than an apparatus limitation, and the recitation of a particular type of gas does not limit an apparatus claim, see *In re Casey,* 152 USPQ 235; *In re Rishoi,* 94 USPQ 71; *In re Young,* 25 USPQ 69; *In re Dulberg,* 129 USPQ 348; *Ex parte Thibault,* 64 USPQ 666; and *Ex parte Masham,* 2 USPQ2d 1647. MPEP 2114 and MPEP 2115. Moreover, the process gas function as a cooling gas, due to the ability to transfer of heat from the substrate surfaces as the gas flows over them. Additionally, the gas injection port may be considered to have an injection end with a gentle slope formed at a predetermined region of the injection end (*See Halpin*, *the horizontally formed aperture at the end of vertical needle valve indicated by 94 Figure 2*) such that at least a portion of the gas being injected can flow along the lateral wall of the chamber based at least upon the diffusion of the gas as it exits the port, and may be considered to have a steep slope formed at a rest region of the injection end (*See Halpin*, *the vertically formed channel of the exhaust path, indicated by 94 Figure 2 and Column 11, Lines 9-36*). <u>The injection ends are next to the lateral walls of the chamber (*See Halpin, arrangement of 94 Figure 2 to sidewall of chamber)* such that they are implicitly against the lateral walls of the chamber.</u>

48. Furthermore, it has been held that claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959).* Also, a claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).* MPEP 2114 and MPEP 2115.

49. **Claims 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6143079 to Halpin in view of U.S. Patent No. 6391804 to Grant et al and U.S. Patent Application No. 2005/0268567 to Devine et al, as applied to Claim 1 above, and in further view of U.S. Patent No. 6501191 to Tanaka et al.**

50. The teachings of Halpin in view of Grant et al and Devine et al are relied upon as set forth above.

51. In regards to Claim 7, Halpin in view of Grant et al and Devine et al do not teach each of the processing gas exhaust ports is provided with an oxygen concentration detector.

52. Tanaka et al teach a heat treatment apparatus (*See Tanaka et al, 20 Figures 9 and 10*) with oxygen sensors (*See Tanaka et al, 89a-c Figures 9 and 10*) that detect oxygen concentration upstream of the exhaust mechanism, i.e., processing gas exhaust ports. The oxygen sensors, i.e., oxygen concentration detectors are used to detect oxygen concentrations as oxygen levels above predetermined limits increase the dielectric constant of the formed interlayer insulating film, rendering the films nonuniform

in the film quality of the wafer (*See Tanaka et al, Column 1 lines 44-49*). Tanaka teaches that increased oxygen concentrations during processing increases the dielectric constant of the formed interlayer insulating film, which renders the films nonuniform in the film quality of every wafer (*See Tanaka et al, Column 1 lines 31-49*).

53. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing system of Halpin in view of Grant et al and Devine et al by adding oxygen concentration detectors with each of the processing exhaust ports, as taught by Tanaka et al. One would be motivated to do so, with a reasonable expectation of success, to monitor oxygen levels to keep them at or below a predetermined limit to ensure the film quality of every wafer.

54. **Claims 9, 10, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6143079 to Halpin in view of U.S. Patent No. 6391804 to Grant et al and U.S. Patent Application No. 2005/0268567 to Devine et al, as applied to Claims 1 and 13 respectively above, and in further view of U.S. Patent No. 6133152 to Bierman et al**.

55. The teachings of Halpin are relied upon as set forth above.

56. In regards to Claim 9, Halpin in view of Grant et al and Devine et al do not teach the edge ring-support comprises: a rotational member installed in the chamber and having a rotational wing with a groove formed on an upper surface of the rotational wing; a cylinder connected to the rotational wing and mounting the edge ring on an upper surface of the cylinder; a cylinder guide engaged with the cylinder; and a cylinder guide-fixing pin for fixing the cylinder guide to the rotational wing.

57. Bierman et al teach an rapid thermal processing chamber (*See Bierman et al, 100 Figure 2*) with a rotor system (*See Bierman et al, 111 Figure 2*), i.e., rotational member with an edge ring (*See Bierman et al, 119 Figure 5*) that is supported by a support cylinder (*See Bierman et al, 115 Figure 5*), such that the edge ring is mounted on an upper surface of the cylinder (*See Bierman et al, Figure 5*). The cylinder is connected to a rotor (*See Bierman et al, 113 Figure 5*), i.e., rotational wing, which has a groove on an upper surface for receiving locator pins (*See Bierman et al, 123 Figure 5*), i.e., cylinder guide. The cylinder guide touches the cylinder, i.e., is engaged with the cylinder and has a pin plug (*See Bierman et al, 159 Figure 5*), i.e., cylinder guide-fixing pin, that friction-fit secures, or fixes, the cylinder guide to the rotational wing (*See Bierman et al, Column 8 lines 39-44*). The rotational member taught by Bierman reduces the occurrence of multiple gas vortices in a semiconductor processing chamber, which in turn reduces film non-uniformity (*See Bierman et al, Column 2 lines 23-31 and Column 4 lines 32-50*), i.e., improves film quality.

58. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing system's edge ring-support as taught by Halpin, with the rotational member for substrate support of Bierman et al. One would be motivated to do so, with a reasonable expectation for success, to reduce the occurrence of multiple gas vortices in a semiconductor processing chamber, which in turn reduces film non-uniformity, i.e., improves film quality.

59. In regards to Claim 10, Halpin does not teach a rapid thermal processing system further comprising a cooling/heating water-circulation passage provided in an inner wall

of the chamber such that the circulation passage surrounds an outer peripheral surface of the edge ring and a predetermined area of the edge ring-support.

60. Bierman et al teach of a water-cooled stainless steel bearing cover (*See Bierman et al, 161 Figure 5*), i.e., a cooling/heating water circulation passage provided in an inner wall of the chamber such that the circulation passage surrounds an outer peripheral surface of the edge ring and a predetermined area of the edge ring support (*See Bierman et al, Column 9 lines 22-25*). The water circulation passage protects components below it from corrosion by the deposition process (*See Bierman et al, Column 9 lines 22-29*). Bierman et al further teaches a circulation circuit with chambers (*See Bierman et al, 146 Figure 5*) fed by coolant inlets (*See Bierman et al, 185 Figure 5*) for circulating cooled gas or liquid (*See Bierman et al, column 6 lines 62-65*) that behaves as a cooling reflector to enable precise temperature measurements (*See Bierman et al, Column 2 lines 11-19)* and can alternatively be a cooling/heating water circulation passage provided in an inner wall of the chamber such that the circulation passage surrounds an outer peripheral surface of the edge ring and a predetermined area of the edge ring support.

61. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing system as taught by Halpin, with the cooling/heating water circulation passages as taught by Bierman. One would be motivated to do so, with a reasonable expectation of success, to protect the components below it from corrosion and to provide a cooling reflector for precise temperature measurements.

62. In regards to Claim 14, Halpin in view of Grant et al and Devine et al do not teach the cooling/heating water-circulation passage has a groove formed around an outer surface of the cooling/heating water-circulation passage facing the inner wall of the chamber, and the rapid thermal processing system may further comprise a third cooling gas injection part and a third cooling gas exhaust part installed in the chamber being connected to the groove, respectively.

63. Bierman teaches the cooling/heating water-circulation passage has a side channel for circulating purge gas (*See Bierman et al, 175 Figure 5*), i.e., groove formed around an outer surface of the cooling/heating water-circulation passage facing the inner wall of the chamber (*See Bierman et al, Column 11 lines 17-33*). Bierman teaches the rapid thermal processing system may further comprise another purge gas source, i.e., third cooling gas injection part and a third cooling gas exhaust part installed in the chamber being connected to the groove, respectively. The third cooling gas ensures that a continuous back pressure is maintained so that deposition does not occur on the backside of the substrate (*See Bierman et al, Column 11 lines 34-39*).

64. It would have been obvious to one of ordinary skill in the art at the time of the invention, to modify the rapid thermal processing apparatus of Halpin in view of Grant et al and Devine et al, with the third cooling gas as taught by Bierman et al. One would be motivated to do so, with a reasonable expectation of success, to ensure that a continuous back pressure is maintained so that deposition does not occur on the backside of the substrate.

65. **Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6143079 to Halpin in view of U.S. Patent No. 6391804 to Grant et al and U.S. Patent Application No. 2005/0268567 to Devine et al, as applied to Claim 1 above, and in further view of U.S. Patent Application No. 2006/0057799 to Horiguchi et al**.

66. The teachings of Halpin in view of Grant et al and Devine et al are relied upon as set forth above.

67. In regards to Claim 12, Halpin in view of Grant et al and Devine et al does not teach the first cooling gas injection part comprises a plurality of injection holes radially arranged therein, and a cap installed at an upper portion of the injection holes to define a predetermined space opened between the injection holes and the cap.

68. Horiguchi et al teach of a substrate processing apparatus, i.e., rapid thermal processing system, with a processing vessel, i.e., chamber with an inner surface of arcs connected by straight lines (*See Horiguchi et al, 22 Figure 9*), a rotational drive unit edge ring-support (*See Horiguchi et al, 28 Figure 9*) with a susceptor (*See Horiguchi et al, 118 Figure 9*), i.e., edge ring, and a gas supply unit (*See Horiguchi et al, 34 Figure 9*). Horiguchi et al further teaches that the gas supply openings has a gas injection nozzle unit (*See Horiguchi et al, 93 Figure 19*) which is connected to a supply line (*See Horiguchi et al, 99 Figure 19*) with radially arranged injection holes (*See Horiguchi et al,* 93_{a1}-93_{an} *Figure 19 and Figure 20*), and nozzle plates(*See Horiguchi et al,* 93_{b1}-93_{bn} *Figure 19*), i.e., caps, installed at an upper portion of the injection holes to define a predetermined space (*See Horiguchi et al,* 93_{c1}-93_{c3} *Figure 19*) opened between the

injection holes and the cap. Horiguchi et al teach that the gas nozzle apparatus directs the gas injection through the entire width of the processing space at a constant flow rate to produce an evenly formed film on the substrate, i.e., wafer (*See Horiguchi et al, Paragraph 0185 and 0191*).

69. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the gas injection ports of Halpin in view of Grant et al and Devine et al by adding a nozzle as taught by Horiguchi et al. One would be motivated to do so, with a reasonable expectation of success, to direct the gas through the entire width of the processing space at a constant flow rate to produce an evenly formed film on the wafer.

Response to Arguments

70. Applicant's arguments with respect to claims 1, 3, and 5-14 have been considered but are not persuasive.

71. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the outer peripheral “edge” surface of the window) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Furthermore, the substitution of the quartz window of Halpin with the quartz window assembly of Devine et al, as per the original 103 rejection, remedies anything lacking in the original 102b.

72. In response to applicant's argument that the inner chamber shape of Grant et al does not have a central angle about each of the arcs, it is noted that the relative arc centers are a characteristic of the shape of the inner chamber, thus part of the result effective variable that Grant et al teaches-- *that the wafer exhibits spatial temperature nonuniformities that are dependent on the walls of the enclosed process chamber (See Grant et al, Column 1 lines 63-67 and Column 2 lines 1-2) and that the generally hexagonal enclosed process chamber is shaped in order to reduce temperature measurement errors induced by lamp radiation by the concentrically located edge ring (See Grant et al, Column 2 lines 62-67 and Column 3 lines 1-5), such that the shape of the chamber is a result-effective variable in uniformly processing the wafer*. Furthermore, as the inner chamber has six straight line sides and six curves connected by the straight lines (*See Grant et al, Figure 2*). The chamber there has 6 lines and arcs distributed around 360°, such that the twelve sides could be divided equally around the chamber and the arcs would have a central angle of 30° (*See Grant et al, Figure 2*).

73. It is argued that the central angle of Grant et al is with the straight lines and not the arcuate portions of the chamber. However, the proportions of features in a drawing are not evidence of actual proportions when drawings are not to scale. See MPEP 2125. Thus it is therefore reasonable to ascertain because there are 6 curves and 6 straight lines, the degree of curvation around the relative centers of the arcuate portions could be evenly distributed, and thus within the range as recited in the claim. Furthermore, because the shape and therefore the degree of curvature of the arcuate portions of the inner chamber is part of the result effective variable of the processing

uniformity of the wafer/substrate, it would be within reason to adjust the degree of the central angles of the arcs in order to obtain more uniform processing and as it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller,* 105 USPQ 233. See MPEP 2144.05 II (A) and case law therein.

74. Furthermore, a change of shape is generally recognized as being within the skill of one of ordinary skill in the art. It is noted that Applicant has not made any showing of criticality shape of the inner chamber that would tend to point toward the curved/straight line inner chamber shape as a matter of choice. *In re Dailey,* 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See MPEP 2144.04 IV B.

75. In reference to the argument that Halpin does not teach the recited inner chamber angles and straight line shape, *as per the original rejection*, it would have been obvious to one of ordinary skill in the art at the time of the invention to alternatively modify the teachings of Halpin to change the size of the relative central angle of the arcs as taught by Grant et al, through routine experimentation, for the predictable result reduce temperature measurement errors induced by lamp radiation and prevent wafer spatial temperature nonuniformities. It is noted that Applicant has not made any showing of criticality in the size of the central angle that would tend to point toward the non-obviousness of freely selecting any arc central angle as a matter of choice to obtain desired temperature uniformity. See MPEP 2144 - IV.

76. It would have been *further* obvious to one of ordinary skill in the art at the time of the invention, with a reasonable expectation of success, to alternatively substitute

chamber inner surface of Halpin with the chamber inner surface as taught by Grant et al, as art-recognized equivalent means for providing an inner surface shape of the chamber. It has been held that an express suggestion to substitute one equivalent component or process for another is not necessary to render such substitution obvious. *In re Fout*, 675 F.2d 297, 213 USPQ 532 (CCPA 1982). See MPEP 2144.06 II.

77. Additionally, it is argued that the central angle of Grant et al is with the straight lines and not the arcuate portions of the chamber. However, the proportions of features in a drawing are not evidence of actual proportions when drawings are not to scale. See MPEP 2125. Thus it is therefore reasonable to ascertain because there are 6 curves and 6 straight lines, the degree of curvation around the relative centers of the arcuate portions could be evenly distributed, and thus within the range as recited in the claim. Furthermore, because the shape and therefore the degree of curvature of the arcuate portions of the inner chamber is part of the result effective variable of the processing uniformity of the wafer/substrate, it would be within reason to adjust the degree of the central angles of the arcs in order to obtain more uniform processing and as it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. I*n re Aller,* 105 USPQ 233. See MPEP 2144.05 II (A) and case law therein.

78. Furthermore, a change of shape is generally recognized as being within the skill of one of ordinary skill in the art. It is noted that Applicant has not made any showing of criticality shape of the inner chamber that would tend to point toward the curved/straight

line inner chamber shape as a matter of choice. *In re Dailey,* 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See MPEP 2144.04 IV B.

Conclusion

79. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

80. Furthermore, Applicant's amendment (relative centers, against lateral wall) necessitated any new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

81. A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

82. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIFFANY NUCKOLS whose telephone number is (571)270-7377. The examiner can normally be reached on Monday through Friday 9:00AM - 5:30 PM.

83. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

84. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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